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On: 19 February 2013, At: 03:27

Publisher: Routledge

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Journal of Psychoactive Drugs

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/ujpd20>

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Version of record first published: 14 Sep 2011.

To cite this article: Pearl P. Nyi, Emily P. Lai, Diana Y. Lee, Shannon A. Biglete, Gilsky I. Torreecer & Ilene B. Anderson (2010): Influence of Age on Salvia Divinorum Use: Results of an Internet Survey, *Journal of Psychoactive Drugs*, 42:3, 385-392

To link to this article: <http://dx.doi.org/10.1080/02791072.2010.10400701>

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Influence of Age on *Salvia Divinorum* Use: Results of an Internet Survey†

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Abstract— An Internet-based survey of *Salvia divinorum* (“salvia”) users was conducted to identify correlates surrounding its use. Salvia-knowledgeable persons were recruited via “social networking Internet websites” (n = 23) where notices were posted on recreational salvia group message boards (n = 69). Data collection included demographics, use circumstances, experiences, and age (current and at first salvia use). A total of 219 surveys were analyzed. Salvia users who were young adults (≤ 21 yrs) at first use favored salvia for fun (OR = 1.94, CI = 1.08-3.49, $p = 0.03$) or to relieve boredom (OR = 2.06 CI = 1.09-3.91, $p = 0.02$), while salvia users who were adults (≥ 22 yrs) at first use favored salvia for spiritual effects (OR = 2.63, CI = 1.02-6.75, $p = 0.04$). Being an adult at first use was associated with higher odds of concurrent marijuana (OR = 2.68, CI = 1.50-4.78, $p = 0.0007$) or tobacco use (OR = 1.94, CI = 1.05-3.60, $p = 0.03$). Over half of all respondents reported use reduction or cessation in the past 12 months (114 of 219, 52%), citing dislike of the high (33.3%) or loss of interest in salvia (28.9%). Reports of cessation suggest salvia use may be more attributed to curiosity than continual abuse.

Keywords— abuse, psychoactive, internet survey, *Salvia divinorum*, use

Salvia divinorum is a perennial herb in the mint family native to Mexico and Central and South America (NIDA 2007; Vortherms & Roth 2006). It was traditionally used for its hallucinogenic properties by the Mazatec Indians

of Oaxaca, Mexico for shamanistic purposes (NIDA 2007; Vortherms & Roth 2006). In addition, *Salvia divinorum* has also been used for various healing purposes including pain relief, diarrhea, and for the treatment of neurologic diseases (Weissner 2009). In the modern world, *Salvia divinorum* has been increasingly recognized for its abuse potential by sources that range from the general media to federal authorities. An Internet search using the term “salvia” results in hundreds of thousands of website resources providing information on its history, instructions regarding recreational use, as well as how to purchase *Salvia divinorum*. According to the Substance Abuse and Mental Health Services Administration’s (SAMHSA) report on hallucinogen use, about 1.8 million people aged 15 years or greater used *Salvia divinorum* at least once in their lifetime (SAMHSA 2008). It is important to note that hundreds of salvia species exist that do not contain any psychoactive substances. Although the term “salvia” is commonly used as a colloquial term for *Salvia divinorum*, the hundreds of nonpsychoactive salvia species should not be confused with *Salvia divinorum*, the

†This study was funded in part by NIDA grant RO1-DA 14935. It was conducted as a partial requirement to earn a doctor of pharmacy degree from the School of Pharmacy, University of California, San Francisco for the following authors: Nyi, Lai, Lee, Biglete and Torrecer. Ilene B. Anderson served as the senior author and takes full responsibility for the integrity and accuracy of the data.

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specific species that is psychoactive and the only species that is addressed in this study. To minimize repetition, the term “salvia” will refer specifically to the *Salvia divinorum* species throughout this article.

Interestingly, *Salvia divinorum* is structurally different from the prototypical psychoactive substances, LSD and mescaline, which act at serotonin receptors (Roth 2002). Salvia's active component is thought to be salvinorin A, a neoclerodane diterpene (Roth 2002). Salvinorin A has been shown to be a potent kappa opioid receptor agonist (Vortherms & Roth 2006; Roth 2002). Binding at kappa opioid receptors is known to result in neurologic effects including sedation, analgesia, and perceptual disturbances (Hooker et al. 2008; Roth 2002). Its agonistic activity at kappa opioid receptors likely plays a role in the hallucinogenic effects of salvia (Roth 2002).

Due to its potential for abuse and possible addiction, 13 states have instituted legal restrictions on salvia use as of November 2008 (Office of Diversion Control 2008). Delaware, Florida, Illinois, Kansas, Mississippi, Missouri, North Dakota, Oklahoma, and Virginia have all named *Salvia divinorum* or salvinorin A as a Schedule I substance, indicating that it has potential for abuse, has no proven medicinal use, and is not recognized as safe (Office of Diversion Control 2008; US DEA 2002). Worldwide, Finland, Denmark, and Australia have prohibited the use, cultivation, and selling of *Salvia divinorum* (Office of Diversion Control 2008). In California, however, salvia remains legal. In addition, it is easily cultivated and its purchase remains readily accessible in all states and around the world via Internet websites. We identified 23 “social networking Internet websites” (e.g. Facebook, LiveJournal) through which to identify individuals who were likely to be knowledgeable regarding salvia use. This information was based on testimonials, videos, or membership in salvia use groups. Over 1,211 self-identified salvia users were identified in this search. These numbers suggest that our research would likely affect a broad spectrum of people across the United States.

While numerous Internet websites cite testimonials describing the effects of salvia when used for recreational purposes, it is vastly understudied and little information regarding toxicity or adverse effects is available. A 2004 survey of salvia users found that about 25% experienced positive antidepressant-like effects for approximately 24 hours following use (Baggott & Erowid 2004). However, about 5% of users experienced lingering negative effects, including anxiety, dizziness, and lack of coordination (Baggott & Erowid 2004). Although salvia appears to have little potential for physical dependence, there still remains a great possibility for negative effects related to use.

As salvia is currently legal in most U.S. states and non-U.S. countries, and sold without age restrictions, we dichotomized our subjects by age at first use (21 years of age or less vs. 22 or more years of age) to explore potential differences in the source, frequency, method, and reasons

related to salvia use. Through this investigation, we hoped to identify associated motivations, circumstances, demographics, and adverse effects. Also, it was hoped that this study would identify key findings that could be useful to health care practitioners as well as policy makers.

METHODS

Overview

In order to determine the use and/or abuse patterns among *Salvia divinorum* users, we developed an anonymous, Internet-based, self-completed, structured survey instrument to collect data among knowledgeable salvia users and ex-users. An innovative recruiting method was utilized in which self-identified users were systematically and specifically targeted within social networking websites (e.g. Facebook, LiveJournal). Notices were posted to selected groups indicating interest or experience in the recreational use of salvia and key data points were then collected. This innovative recruitment method allowed the study to successfully target the specific population that we wished to survey. This study was approved by the Committee on Human Research at the University of California, San Francisco.

Survey Development and Content

We created a 33 question survey instrument designed to address the following characteristics surrounding recreational use of salvia: age at first use, frequency and method of use, health literacy concerning *Salvia divinorum*, reasons or beliefs for use, concurrent use with other legal and/or illegal substances, sources used in gaining information about and physically obtaining salvia, and experiences associated with salvia use including behavioral changes and adverse effects. Participant demographics collected included education, socioeconomic status, and ethnicity. Pilot testing revealed an average completion time of seven minutes.

Identification of Target Populations

Internet websites were utilized as the sole vehicle for subject recruitment in this study. In order to ensure a robust sample size for the purposes of this study, we chose to post our survey on networking sites that would yield a high frequency of responses. Recruitment consisted of inclusion from social networking websites likely to be visited by individuals knowledgeable of salvia or illicit drug use. We used the *Wikipedia* List of Social Networking Websites (*Wikipedia* 2008) posted on September 14, 2008 to formulate an initial list of sites ($n = 77$) which we systematically evaluated to identify those likely to be visited by salvia-knowledgeable individuals ($n = 23$). Networking sites met inclusion criteria if the search term “salvia” or “*Salvia divinorum*” yielded groups with any interest in or discussion of salvia. Reasons for exclusion of certain websites on the *Wikipedia* list are detailed in Table 1.

TABLE 1
Recruitment by Internet Website: Inclusion and Exclusion Criteria

Internet Websites by Inclusion & Exclusion Criteria	N	%
Total Potential Internet Websites*	77	100%
Excluded Websites		
Foreign/Non-English Predominant Language	28	
Unable to Search Website for Search Term	11	
Invitation Only	6	
Teens Only	1	
Unable to Contact Individual/No Group	1	
Closed/Scheduled to Close	4	
Mobile Community	3	
Total Excluded Websites	54	70%
Total Included Websites used in Subject Recruitment	23	30%

*Websites were comprised of Wikipedia's list of social networking sites (Wikipedia 2008)

Survey Subject Recruitment

Participants were recruited from selected websites as described above. The survey was advertised by posting a study recruitment announcement, including the study's direct URL hyperlink, on all message boards or forums for groups ($n = 69$) meeting the inclusion criteria. In some cases, the advertisement was sent via group email. For certain websites, posting the survey required the investigators to join the respective group of interest as a member prior to advertisement. Of note, subjects had an opportunity to submit questions or concerns regarding the contents of the survey via voicemail (a phone number was also provided). Investigators fielded all questions on a daily basis.

It is also noteworthy to mention that this innovative recruitment method was time-consuming, faced various restrictions, and presented several limitations. Certain websites allowed only a limited number of postings per day (e.g. Yelp) prior to being "locked out," "warned," or "banned" to prevent users from "spamming." To circumvent further losses from our sample size, survey postings were on occasion reduced to two or three times weekly. In addition, other websites held content restrictions for posting to the discussion boards. Therefore, although posting to communities or groups that required administrator review or approval was systematically attempted, publication of the recruitment announcement was left to the discretion of the administrator (e.g. LiveJournal). Those groups that listed salvia as an interest but had not been updated in over six months were screened for content to determine if recreational use was discussed. Only communities with relevant salvia discussions were then targeted.

Survey Administration

This self-administered study was conducted solely via the Internet over a 10-week period (November 20, 2008 through January 31, 2009). The survey was posted using

a unique URL (https://ihrc.ucsf.edu/Collector/Survey.ashx?Name=Salvia_FINAL) created by DatStat, the UCSF-affiliated survey software company under the auspices of the UCSF Internet World Health Research Center (IWHRC). Collection and processing of data met the Committee on Human Research standards and was Health Insurance Portability and Accountability Act (HIPAA)-compliant. No personal identifying information, electronic or otherwise, was collected. All data was stored in a secure, password-protected customized database accessible only by study investigators. There was no financial or other incentive provided for participation.

Subject inclusion criteria included: (1) self-stated age was 18 years or older; (2) self-reported current or past salvia use; (3) access to the Internet; (4) ability to read and understand English; and (5) voluntarily consented and initiated survey participation. Only subjects meeting study eligibility requirements were allowed access to the study information screen containing the actual survey content. Participants could refuse to answer any question or end the survey at any time.

Summary Data for Survey Internet Site Inquiries

A total of 349 individuals visited the survey site. Of these individuals, 126 (36.1%) declined to answer at least 40% of the survey questions and were excluded from this analysis. Importantly, 87% (109 of the 126 excluded) answered less than 15% of the survey questions. An additional four individuals (1.2%) did not provide a response for age at time of first salvia use and were therefore excluded. Ultimately, 219 completed surveys were included in this statistical analysis.

Data Analysis

We used descriptive statistics to describe the frequencies of side effects and other substance use reported among the

TABLE 2
Demographic Characteristics for 219 Survey Respondents Analyzed

Subject Characteristic	All N = 219	Age at First Salvia Use		P Value
		Age ≤21 Young Adult N = 133 (61%)	Age ≥22 Adult N = 86 (39%)	
Current Age in Years*, mean ±SD	24.4±6.6	20.9±2.3	29.9±7.6	<0.0001
Current Age in Years*, median (range)	23 (18-62)	20 (18-27)	27 (22-62)	
Gender Identification, n (%)				0.03
Male	133 (61%)	73 (55%)	60 (70%)	0.0003
Female	83 (38%)	59 (44%)	24 (28%)	
Transgender	2 (1%)	1 (1%)	1 (1%)	
Country of Origin, n (%)				0.0003
U.S.	134 (61%)	94 (71%)	40 (47%)	0.97
Non-U.S.	85 (39%)	39 (29%)	46 (53%)	
Race/Ethnicity n, (%)				0.21
Asian	4 (2%)	2 (2%)	2 (2%)	
Black	3 (1%)	2 (2%)	1 (1%)	
Hispanic or Latino	6 (3%)	4 (3%)	2 (2%)	
White	194 (89%)	117 (88%)	77 (90%)	
Other, or Mixed	9 (4%)	6 (5%)	3 (4%)	
Sexual Orientation n, (%)				0.21
Heterosexual	171 (78%)	99 (74%)	72 (84%)	
Gay, Lesbian or Bisexual	44 (20%)	30 (23%)	14 (16%)	

*Age ≥18 years for all, but exact age not reported by 16 young adult and 13 adult respondents. Gender was not reported by one adult subject. Race/ethnicity was not reported by two young adult subjects and one adult subject. Sexual orientation was not reported by four young adult subjects.

survey participants. The frequency of salvia use has risen among adolescents and young adults. For this reason, we divided this survey population into two groups based on age at first time use of salvia: those who were 21 years of age or younger at first time salvia use (defined as “young adults”) and those who were 22 years or older (defined simply as “adults”) at first time salvia use. The t-test was used to calculate the difference for mean age. We largely employed the chi square test to calculate differences in social factors, demographic factors, means of acquisition, and characteristics and reasons for salvia use between the two samples. For the variables that demonstrated a significant difference, defined as a *p* value < 0.05, we further investigated the magnitude of these differences by calculating an odds ratio (OR) with 95% confidence intervals (CI).

RESULTS

Subject Location and Demographics

We analyzed data from 219 survey respondents who reported both lifetime use of salvia as well as age at first-time salvia use. As outlined in Table 2, all survey respondents were at least 18 years of age during the time of survey participation. Survey participants had a median age of 23 years at time of survey response, with a range of 18 to 62 years. Respondents first used salvia predominantly as young adults (61%), defined as less than or equal to 21 years. The young adult sample included 133 survey participants, while the adult sample included 86. Overall, most participants identified

with the male gender (61%); however, when divided by age, there is a shift in female presence. There was a greater proportion of female users in the young adult group as compared to the adult group (44% vs. 28%, *p* = 0.03, OR = 2.02, CI = 1.13-3.63). The young adult group was almost three times as likely to identify with United States (U.S.) residence compared to non-U.S. residence (71% vs 29%, *p* = 0.0003, OR = 2.77, CI = 1.58-4.88). Countries of origin for non-U.S. survey respondents, in order of frequency, included: Russia (41), Canada (17), United Kingdom (9), Poland (4), Ukraine (4), Czech Republic (2), and Netherlands (2), with the remaining countries represented by just one respondent per country (Australia, Moldova, France, Germany, New Zealand, and Spain). Demographic characteristics of the young adult compared to the adult groups were similar in regard to race/ethnicity and sexual orientation. Although data regarding education level, marital status, and employment status were collected, these demographics are likely to be strongly linked to age. Since we expected a large difference between the samples for this reason, we did not analyze this data.

Characteristics of Salvia Use and Acquisition

We compared the characteristics of salvia use and acquisition between young adult and adult survey participants (Table 3). There was no significant difference regarding reason for salvia use between the two groups in terms of frequency of salvia use, source of initial salvia knowledge, or source of salvia purchase. Any reduction or cessation of

TABLE 3
Characteristics of Salvia Use and Acquisition Among 219 Survey Respondents

	Age ≤ 21 Young Adult N = 133	Age ≥ 22 Adult n = 86	P Value
Frequency of Use			0.41
1-2 Times	31 (23%)	24 (28%)	
3-5 Times	58 (44%)	27 (31%)	
6-20 Times	28 (21%)	22 (26%)	
More than 20 Times	12 (9%)	8 (9%)	
Source of Initial Salvia Knowledge			0.14
Friend	78 (59%)	37 (43%)	
Family	45 (34%)	35 (41%)	
Other	10 (7%)	10 (12%)	
Purchase at a Retail Store			0.04
Yes	90 (68%)	41 (48%)	
No	42 (32%)	35 (41%)	
Purchase on the Internet			0.07
Yes	79 (59%)	56 (65%)	
No	54 (41%)	22 (26%)	
Reduction or Cessation of Salvia Use in the Last 12 Months			0.10
Yes	75 (56%)	39 (45%)	
No	56 (42%)	46 (53%)	
Interest in Trying Other Hallucinogens			0.71
Yes	98 (74%)	57 (66%)	
No	32 (24%)	21 (24%)	

Frequency of Salvia use was not reported by four young adult and five adult respondents. Source of recreational potential was not reported by four adult respondents. Purchase at a retail store not reported by one young adult and 10 adult respondents. Purchase on the Internet not reported by eight adult respondents. Reduction or cessation of Salvia use in the last 12 months was not reported by two young adult and one adult respondent. Interest in trying other hallucinogens was not reported by three young adult and eight adult respondents.

salvia use in the last 12 months, or interest in trying other hallucinogens, also did not differ between the two groups. Both groups commonly reported purchasing salvia from a retail store and the Internet. Although the younger adult group more commonly purchased salvia from a retail store, the difference in source of salvia purchase (retail store vs. Internet) between the two groups was marginal: retail store ($p = 0.04$, OR = 1.83 CI = 1.02-3.27), Internet ($p = 0.07$).

Reasons for Salvia Use

Table 4 summarizes the reasons for salvia use. These include: to enhance creativity, for fun, for spiritual effects, and to relieve boredom. There was no difference between the two groups in regards to using salvia to enhance creativity. However, participants who first used salvia as young adults favored using salvia for fun (OR = 1.94, CI = 1.08-3.49, $p = 0.03$) or to relieve boredom (OR = 2.06, CI = 1.09-3.91, $p = 0.02$), while participants who first used salvia as adults favored use for spiritual effects (OR = 2.63, CI = 1.02-6.75, $p = 0.04$).

Concurrent Substance Use with Salvia

Survey respondents were asked about concurrent substance use with salvia. Using salvia for the first time as an adult was associated with almost three times higher odds of concurrently using marijuana with salvia (OR = 2.68, CI = 1.50-4.78, $p = 0.0007$). In addition, first time use as an adult

was also associated with a two-fold odds of using tobacco in conjunction with salvia (OR = 1.94, CI = 1.05-3.60, $p = 0.03$). There was no difference in concurrent alcohol and salvia use between young adult and adult groups.

Effects and Other Substance Use

We collected and analyzed data from 219 survey participants who completed the survey. Since salvia is a hallucinogen, expectedly, the most common effects reported were visual effects, including hallucinations (77.6%), distorted images (66.8%), merging of objects (59.2%), and color changes (57.4%). Other common effects were consistent with the herb's strong dissociative effects including sensation of entering or perceiving other dimensions or realities (75.8%), confusion (64.6%), and loss of coordination/inability to control muscles/maintain balance (63.7%). Less common effects included depersonalization (57.4%), uncontrolled laughter (55.2%), feeling happy (55.2%), and experiencing past memories (27.4%). Physical changes experienced by users included slowed or slurred speech (51.1%), dizziness (39.9%), and changes in body temperature (39.4%). Some undesirable side effects included fear/panic (38.6%), paranoia (23.8%), feeling sad (13.9%), nausea (9.0%), and irritability (9.0%).

In addition to concurrent substance use in the same sitting as salvia, survey respondents were also asked about general use of other substances. The most common agents

TABLE 4
Reasons for Salvia Use Among 219 Survey Respondents

	Age ≤ 21 Young Adult N = 133	Age ≥ 22 Adult N = 86	P Value	OR	(95% CI)
Enhance Creativity			0.72	-	
Yes	80 (61%)	48 (63%)			
No	52 (39%)	28 (37%)			
Fun			0.03	1.94	(1.08-3.49)
Yes	83 (65%)	36 (49%)			
No	44 (35%)	37 (51%)			
Spiritual Effects			0.04	2.63	(1.02-6.75)*
Yes	108 (82%)	71 (92%)			
No	24 (18%)	6 (8%)			
Relieve Boredom			0.02	2.06	(1.09-3.91)
Yes	52 (40%)	18 (25%)			
No	77 (60%)	55 (75%)			

*OR in favor of adults; young adults less likely to use for spiritual reasons OR = 0.38, (0.15-0.98)

Use to enhance creativity was not reported by one young adult and 10 adult respondents. Use for fun was not reported by six young adults and 13 adult respondents. Use for spiritual effects was not reported by one young adult and nine adult respondents. Use to relieve boredom was not reported by four young adult and 13 adult respondents. Note that the % listed is calculated based on the number of respondents who answered each particular question.

reported also being used were marijuana (50.2%), tobacco (32.7%), and alcohol (30.0%). Other substances reported include psychedelics (LSD [lysergic acid diethylamide], PCP [phencyclidine], ketamine, or shrooms [psilocybin]) in 8.1% of total respondents, uppers (amphetamines, speed, cocaine, crack, crack) in 5.4%, downers (ValiumTM, heroin, SomaTM, GHB [gamma hydroxybutyrate], VicodinTM) in 4.0%, Ecstasy (MDMA [methylenedioxymethamphetamine], E) in 4.0%, and dextromethorphan (eg: DXM, Triple C, CoricidinTM, Robitussin DMTM) in 3.1%.

Reduction or Cessation of Salvia Use

Although there was no significant difference between the young adult and adult groups, over half of all survey respondents reported reduction or cessation of salvia use in the last 12 months (114 of 219, 52%). Of these, 100 participants provided a reason for reduction or cessation (Table 5). The top reasons were: not liking the high achieved from salvia (33.3%) and simply losing interest in salvia (28.9%).

DISCUSSION

One observation that can be made from this survey is the prevalence of young salvia users, which may demonstrate a shift in the reasons for, and characteristics of, salvia use. The National Survey on Drug Use and Health (NSDUH) estimated that 1.8 million persons aged 12 or older had used *Salvia divinorum* in their lifetime (SAMHSA 2008). We surveyed a relatively small number of salvia users to capture sociodemographic factors that could be used to identify important correlates regarding salvia use. The overall age of salvia users appears to be consistent with previous studies

(SAMHSA 2008). Likewise, salvia use among young adults (18 to 21 years) was more common than among adults (22 years or older). Salvia use is more common among males than females. The NSDUH reports that among individuals 18 to 25 years old, salvia use was up to four times more common in males than in females (SAMHSA 2008). A previous study of college students also suggested males were a subpopulation more likely to use salvia (Lange et al 2008). Interestingly, our data shows a shift in the population of salvia users: among young adults 21 years of age or younger, the male to female ratio is closer to 1:1. While our definition of young adults differed from that of the NSDUH, this finding still raises an important consideration that warrants further exploration: there may be increased interest in salvia use among younger females.

Because salvia is legal in most U.S. states and non-U.S. countries and sold without age restrictions, it is not surprising that there is high accessibility through both Internet and retail purchase, and that no significant difference was seen across age at first use.

Salvia has gained widespread popularity in the media targeting young audiences including television, YouTube, and Ebay. For this reason, there is growing concern that an increasing number of individuals, especially adolescents and young adults, may turn to salvia for recreational use and abuse. Salvia has been coined "the next marijuana" by many concerned individuals, including parents, religious groups, and political activists (Mueller 2008). However, findings from the present study may contradict this claim. Most of our respondents reported only using salvia five times or less in their lifetime. In fact, about half of these participants reported a reduction in or cessation of salvia use, listing

TABLE 5
Stated Reason for Reduction or Cessation of Salvia Use Among 114 Respondents

Reason for Reduction or Cessation of Salvia Use	N	%
Any Health and Safety Concerns	43	37.7
Didn't like the High	38	33.3
Health Risks	5	4.4
Any Legal or Other Non-Health Risks	57	50.0
Lost Interest	33	28.9
Difficult to Acquire	2	1.8
Legal Risks	6	5.3
Too Expensive	9	7.9
Other	7	6.1
Declined to State a Reason	14	12.3

unpleasant highs and loss of interest as the top reasons for the change in use. Therefore, it is not surprising that salvia sellers report having few repeat customers because "most users don't enjoy the experience" (Wincele 2008).

Additionally, the results of this survey indicate that the reasons for salvia use differ between young adults and adults. Participants who used salvia for the first time as young adults were more likely to use it for fun or to relieve boredom. Such reasons may translate to curiosity or experimentation. On the other hand, participants who used salvia for the first time as adults were more likely to use it for spiritual effects. An explanation for the different reasons for use between the two samples may be maturity. Sagewisdom.org states those who are most attracted to salvia are mature and philosophically minded (Sagewisdom 2009). The adult group claimed to use salvia for a focused reason or spiritual effects, much like the Mazatec shamans did to facilitate visions during healing.

Based on the reported predominance of younger salvia users in this study, and their respective interest for use being for fun and to relieve boredom, a potential observation can be made. Perhaps a large component of the increased salvia use among young adults can be attributed to curiosity and experimentation rather than continued recreational use and abuse. This is further supported by reasons for cessation, as well as previously reported low numbers of repeat salvia customers as described above.

Limitations

Certain limitations are undoubtedly evident both in the methodology and design of this salvia research survey. As noted in the methodology, Internet access, age, and language were requirements for initial participation, thus limiting the overall pool of salvia users. It is unknown whether visitors to Internet-based social networking websites are representative of the larger population of recreational salvia users, or of a younger population with higher levels of education or greater financial resources. Respondents to the salvia survey were additionally limited to those who filtered in through the sources described in detail above. Namely, these limitations include membership or access to the websites selected as

target recruitment venues, subsequent logging on to such websites within the time window in which the advertisement remained easily visible, and participation in the actual salvia survey during the period of active enrollment. The pool of salvia users responding to the survey could thus be subject to seasonal, vocational, or other factors unknown to the researchers.

Recruitment was also highly variable between websites, as well as the number of salvia users which can be potentially drawn from each website. While we utilized a systematic Internet-based recruiting approach, this recruitment strategy could still have introduced sampling bias. The sample size of this survey is also relatively small compared to the identified salvia users in our search.

Since this was an anonymous survey, we were unable to rule out the possibility of survey resubmission from any one individual without compromising respondent anonymity. No financial or other incentive for participation was offered to reduce any motivation for multiple responses, although this does not guarantee exclusively single submissions. Surveys with less than 60% of questions answered were also excluded in this analysis to decrease resubmission bias from incomplete entries. Despite this limitation, the anonymous survey design may have produced more reliable responses considering the sensitive subject of substance abuse. In addition, this survey relied on subject self-report and independent confirmation of responses was not possible.

The survey itself was primarily developed using a closed-ended format given the multiple-choice nature of its design. While qualitative data was allowed in responses to certain questions and outlying answers were being captured, analysis of such data is limited by consistency and power. Answers relating graded experiences (extremely likely, likely, somewhat likely, etc.) are also subjective in nature and limited by variability between respondents. Informal piloting of the survey was done, although not extensively, and likely did not provide ideal circumstances in which to pretest. However, previously validated question formats were used whenever possible in designing the survey.

CONCLUSION

Utilizing an innovative Internet-based targeted survey strategy, these findings capture sociodemographic factors that predict characteristics and trends of salvia use based

on age at first use. A predominance of younger salvia users may demonstrate a shift toward using salvia for fun and to relieve boredom rather than for targeted spiritual reasons. However, reports on cessation trends also suggest salvia use may be more attributed to curiosity than abuse.

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